

# NANOEMULSIONS – PRESENT AND FUTURE PERSPECTIVE - AN OVERVIEW

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**ABSTRACT:** In view of the fact that in past decade the growing trend of interdisciplinary research in nanoemulsions have attracted awareness in formulations to design therapeutically effective drug because of its variety of uses in pharmaceutical industry. They are an efficient drug delivery system for transdermal, transocular, transnasal, drugs to brain and even for certain anticancer drugs. When the size of droplets of this non-equilibrium systems is decreased they not only deliver drug in a sustained manner to increases rate of cure of patients and avoids repeated drug administration. Owing to some of its elite properties the nanoemulsions are considered as the effective and genuine novel drug delivery tool compared to conventional drug delivery system which include their thermodynamic stability, viscosity, bioavailability, optical clarity, easy to prepare moreover they are resistant to creaming, flocculation, coalescence and sedimentation. This research paper addresses for the types of nanoemulsions, their signifying features which differentiate them from emulsions and microemulsions, methods of preparations of stable nanoemulsions, their morphology and properties various routes of drug administration in this nanonized formulation. Specifically recent researches regarding practical applications in cosmetology and available patents.

**Key words:** nanoemulsions, transdermal, properties, drug delivery system.

## 1. INTRODUCTION

Nanoemulsions are multiphase colloidal dispersions of two non-equilibrium of structured immiscible liquids that are made to mix with each other so, when liquid is dispersed in another fluid. It is made stable by combination of surfactants and co-surfactants<sup>[1]</sup>. This part formed includes small size droplets with sizes between 5nm-200nm giving a transparent emulsion with decreased interfacial tension between oil & water phase. This availability of large interfacial area influences drug delivery or targeted drug delivery. Nanoemulsions dissolve large amount of oil substances and protects drug hydrolysis in body and degrading enzymes. Nanoemulsions provide sustained release of drug in controlled manner for long time. They are protected against flocculation, sedimentation, creaming effect. When droplet size is reduced to nano scale, it creates many physical properties like optically transparent and elastic behaviour. They provide promising behaviour of droplets after nanonization. Moreover the nanoemulsions on commercial scale can be prepared by a surfactant very less in amount. In this review paper we will try to concentrate on complete review of nanoemulsions, their properties, advantages, disadvantages related to the formation of this drug delivery system and challenges faced by nanoemulsions to commercialise this novel drug delivery system. They are known by various names as miniemulsions, ultrafine emulsions, micrometer emulsions<sup>[1,2]</sup>, milky emulsions, translucent emulsions<sup>[3]</sup>







3. Nanoemulsions are very efficient drug delivery system for transdermal drug delivery which allows their rapid penetration through skin
4. Properties of fluidity at optimum concentration of oil and their optically transparent behaviour gives the subject a pleasant feel when applied on skin
5. In comparison to microemulsions Nanoemulsion preparation is feasible with a comparatively low surfactant concentration that are approved for human consumptions for internal administrations .
6. Even physical properties like spreadibility, moisturizing, and easy skin penetration are contributing factor of small droplet size in nanoemulsions
7. Alcohol base in perfumes can be avoided moreover the fragrance enhancers are easily administered through nanoemulsions formation because of their easy formulations
8. They can be used instead of liposomes and vesicles owing to their higher stability.

### 3.2 Disadvantages Of Nanoemulsions In Drug Delivery Systems

1. Recently it is a drug delivery system which has attracted the interest of researchers because the special instruments that are employed in nanoemulsions formation are now available. This facility was not there in past years
2. Its production is expensive to the industry
3. Role of surfactant and co surfactants along the formation of submicron droplets have to be thoroughly studied.
4. Interfacial chemistry of the substances have to be very well understood before formulating a nanoemulsion from it.

### 4. Morphology of Nanoemulsions

Morphology is Concluded with the help of different microscopy techniques mentioned below:

- A. **Scanning Electron Microscopy (SEM)** - provides a 3-dimensional images of the droplets[ specially with the automated system of SEM a detail analysis of shape and surface morphology is performed <sup>[31]</sup>.
- B. **Transmission Electron Microscopy (TEM)** - provides resolution images of dispersed phase. Its digital image processing helps to analyse micrographs<sup>[32]</sup>.
- C. **PCS ( photon correlation spectroscopy )** is helpful in analyzing the fluctuating intensity in scattering in droplets due to Brownian movement<sup>[33]</sup>.It is helpful in assessing polydispersity index and zeta potential . here polydispersity index measures homogeneity of dispersion of droplets in nanoemulsion <sup>[34]</sup>.and span or width of distribution whereas the zeta potential is a measure of diameter on an average of particle size.
- D. **Viscosity** is a very significant feature for stability and to get efficiency in drug release. Nanoemulsions prepared from oil in water are comparatively less greasy so less viscous compared to water- in – oil











If nanoemulsion production is adapted by various industries the competition will definitely reduce the production cost. Moreover Significant Researches directed towards the field of surfactants and emulsifier system will escort to economical use of surfactants.

Since nanoemulsions are already have wide usages in medical, cosmetics and other fields for production of a variety of versatile products. There extensive usage potential in agricultural, engineering chemical and physical sciences can give promising results.

### 7.1 COMMERCIAL NANOEMULSIONS<sup>[85]</sup>

Many nanoemulsion preparations are commercialized to products available in market for use are listed in Table No.1

**Table No.1-commercial nanoemulsion preparations**

Palmitate alprostadil	Liple	Mitsubishi pharmaceutical, japan.	Vasodilator,platelet inhibitor
Dexamethason	Limethason	Mitsubishi pharmaceutical, japan.	Steroid
Propofol	Diprivan	Astra zaneca	Anaesthetic
Flubriprofenaxtil	Ropion	Kaken pharmaceutical japan.	NSAID
Vitamins A,D,E and K	Vitalipid	Fresenius kabi Europe	Parenteral nutrition.

### 7.2 Patents On Nanoemulsions<sup>[85,88]</sup>

Though many of the patents of nanoemulsions have not been commercialized but that patency has been granted on those formulations.some of the patents<sup>[86-88]</sup> are presented in Table No.2

**Table No.2-Patents on Nanoemulsion Preparations**

Sr. No.	Patent claim	Assignee	Patent Number
1	Transparent nanoemulsions less than 100 nm based on fluid non-ionic amphiphilic lipids and used in cosmetics or in dermopharmaceuticals	L'Oreal (Paris,FR)	US Patent no: 5,753,241.
2	Nanoemulsions based on sugar fatty ethers and it is used in cosmetics, dermatological nad ophthalmological fields	L'Oreal (Paris, FR)	US Patent no:6,689,371
3	Non-toxic antimicrobial compositions and methods of use.	Nano Bio Corporation US	Patent no: 6,559.189 and 6,635,676
4	Method of preventing and treating microbial infections	Nano Bio Corporation US	Patent no: 6,506,803
5	Namoemulsions of 5-aminolevulinic acid	ASAT AG Applied Science and Technology (zug,CH)	Pct/EP99/08711

6	Nanoemulsions of poorly soluble pharmaceutical active ingredient and methods of making same	-----	WO/2007/10324
7	Nanoemulsions based on ethylene oxide & propylene oxide block copolymers and it is used in cosmetics , dermatological & ophthalmological fields.	L'Oreal (Paris, FR)	Patent no: 6,464,990
8	Nanoemulsions based on glycerol fatty esters and its uses in cosmetics, dermatological & ophthalmological fields	L'Oreal (Paris, FR)	Patent no: 6,541,018
9	Nanoemulsions based on oxyethylenated or non-oxyethylenated sorbitan fatty esters and its uses in cosmetics, dermatological and ophthalmological fields.	L'Oreal (Paris, FR)	Patent no: 6,335,022
10.	Nanoemulsions based on phosphoric acid fatty acid esters and its uses in cosmetics, dermatological and ophthalmological fields.	L'Oreal (Paris, FR)	Patent no: 6,274,150

## CONCLUSION

Nanoemulsions are made to improve bioavailability of drug , small size of particles have remarkable physical properties of high penetration, optical clarity and available for all routes of drug delivery, significant therapeutic efficacy, controlled and targeted drug delivery. Recently major advances have been made for anticancer drugs . this review has collected a lot of information about the characteristics , morphology, physical properties, advantages and disadvantages of nanoemulsions compared to conventional drug therapy. In many areas the nanoemulsions are giving very promising results to cure various diseases. Moreover the pharmaceutical industry has explored their effect beyond drugs to biotechnology , nutrition and cosmetics.

## REFERENCES

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